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Contents

volume 16.1

editor's note

Cover art **Maia D'Souza**

In this issue of Current Conservation, we present a diverse collection of articles guaranteed to delight, shock, amuse, and move you.

As the pandemic continues to provide the backdrop to our lives, Alexi Guddal reveals what we have in common with the endangered Oregon spotted frog (hint: social isolation). Even prior to COVID-19, bats had a bad rap for being reservoirs of zoonotic diseases. But Kami Koyamatsu shares with us her fascination for the "coolest creatures ever", who play a crucial role in maintaining the health of ecosystems and, thus, people.

In the article featured on the cover, Maia D'Souza takes us on a journey through humanity's food culture—specifically the widespread use of insects as a food source—pointing to archaeological evidence from the past as well as present-day diets, with clues to the future. This issue also includes a delightful review of Janaki Lenin's recent book 'Ever Creature Has a Story'—a collection of 50 fascinating essays on animal behaviour. And our Research in Translation piece about the cultural dimensions of human-wildlife coexistence in the Trans-Himalayas provides insights on how folklore can be a powerful tool for conservation.

Finally, don't miss the soulful interview with scientist-turned-landscape artist Stephen Redpath, interspersed with original paintings and sketches, or the latest installation of rib-tickling satire from Kartel Shockington with the 'Official Shockington Guide to Conservation Ailments And Diseases' (which includes my personal favourite—'Pristianity', the desire to set aside exclusionary protected areas).

Until next time.

—Devathi Parashuram

Coping with isolation:

What humans now have in common with the Oregon spotted frog

Author **Alexi Guddal** | *Illustrator* **Karunya Baskar**

The COVID-19 pandemic has impacted lives everywhere, including my own. It has been almost a year since I left the office and began working remotely. This change has left me grappling with feelings of isolation that I have never felt before. However, isolation is a phenomenon that impacts species beyond humans. I have come to empathise with one that is native to my hometown in Whatcom County, Washington—the Oregon spotted frog (*Rana pretiosa*).

Their decline has been exacerbated by population isolation, which occurs when small populations of a species can no longer reach each other.

The Oregon spotted frog and I

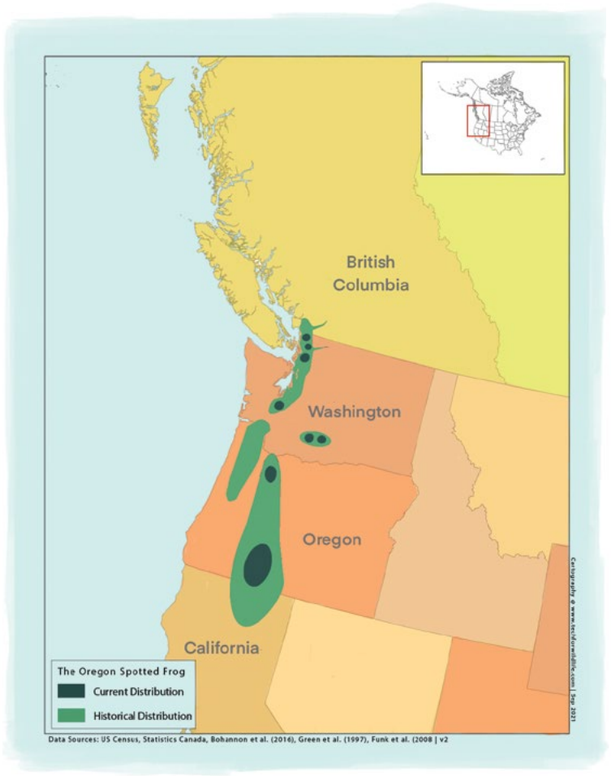
The Oregon spotted frog is my neighbour on the Pacific Northwest coast of the United States of America. They are typically found at lower elevations in still water ponds connected by streams or ditches. Named after the black spots found across their back, Oregon spotted frogs can be green, tan, or red, and they have bright yellow or gold eyes. These frogs were once found in wetlands from southwestern British Columbia to northern California. But they now occupy only 10–30 percent of that territory, concentrated in limited areas of western Washington, southwestern British Columbia, and Oregon. Before the pandemic, I regularly travelled a similar distance, visiting family and friends in British Columbia and Northern California. I now only travel within my small city. This restriction in range makes me claustrophobic at times. However, for the Oregon spotted frog, this habitat limitation has led to them being listed as 'threatened' in the U.S. Endangered Species Act and as 'endangered' in Canada. There are multiple factors influencing the decline of the species. However, the loss and alteration of their wetland habitat is listed as one of the main causes.

Isolation and its consequences

Oregon spotted frogs rarely stray from wetlands. They utilise shallow ponds in the spring during their breeding season, while deeper waters suit their active lifestyle in the summer. In the winter, they seek natural springs, beaver features (areas with water overflowing stream banks or pools created by a dam), and other wetlands with emergent vegetation. Feeding, basking, mating, and movement between seasonal habitats all occur in the water. However, connected landscapes with habitat requirements for all seasons have become increasingly rare. This restriction of movement now feels similar to how almost all my activities are limited to my apartment. Yet, my experience differs from that of the Oregon spotted frog in that I have the option of leaving.

This isolation due to lack of aquatic habitat connectivity occurs at both the population level as well as between seasonal habitats. Population isolation occurs as groups of Oregon spotted frogs that used to congregate during breeding can no longer reach each other. While I currently feel isolated from my family and friends, these frogs have been dealing with isolation from their extended family and friends for generations. This has led to sub-divided genetic groups with low genetic diversity, or genetic variation, due to inbreeding. Maintaining and improving connectivity between seasonal habitats is important for the survival of individual frogs, while reducing population isolation improves the chances of survival of the species overall.

Aquatic habitat connectivity can be disrupted in several ways, with human structures and processes playing a major role. Similar to how I'm restricted by the physical constraints of signs, tape, plastic shields, walls, and other barriers to enforce social isolation; impervious surfaces, such as roads, can create physical barriers between populations of Oregon spotted frogs. Further, unsuitable habitats can also act as a barrier to connectivity if water quality, hydrology, and plant species composition impede movement between habitat patches.



Since receiving my first dose of the COVID-19 vaccination, I'm able to foresee an end to my isolation. While vaccine creation and dissemination brings hope for the end of the worst impacts of the virus, the future of Oregon spotted frog habitat improvement is grim. They have evolved to rely on aquatic habitat for much of their life history. Factors such as precipitation and temperature can have an enormous impact on the connectivity between populations. If the streams and ditches they use to move are dry or too warm, they become further isolated. Climate change projections for the Pacific Northwest also indicate that there will likely be a reduction in the overall water availability, which would create a reduction of water connectivity for the Oregon spotted frog. This in turn leads to further isolation. However, the good news is that we can work towards conservation solutions, similar to how we have worked towards mitigating the effects of the COVID-19 pandemic.

Conservation solutions

Conservation solutions for the Oregon spotted frog are complex and require a multi-pronged approach, similar to the COVID-19 pandemic. We are utilising social distancing measures, vaccine development and deployment, and protective equipment to bring an end to the pandemic. Conservation solutions for the frog depend on decreasing their isolation through maintaining habitat connectivity, expanding and maintaining Oregon spotted frog habitat, and the founding of additional populations.

Captive breeding and head-starting

Some work is already ongoing to potentially reintroduce Oregon spotted frogs into areas that were likely part of their former range. Similarly,

captive breeding, reintroduction, and head-starting programmes are underway in Canada and the United States. In head-starting programmes, young individuals are removed from wild populations and raised in captivity during vulnerable life stages, before being reintroduced into the population. This is comparable to how more vulnerable human populations, such as the elderly or those with autoimmune disorders, had special grocery store hours and other measures to protect them until the vaccine became available.

Captive breeding with reintroduction and head-starting programmes help conserve Oregon spotted frogs by introducing more genetic diversity into isolated populations. However, there are a few challenges. Some studies have shown that wild populations can be harmed by captive-reared reintroductions. This is because those animals do not survive as well, despite increasing genetic diversity. It also takes many captive frogs to have sufficient genetic diversity. This problem is currently being improved by a new method that involves freezing sperm from different individuals, minimizing the number of males needed to be kept in captivity. However, like social distancing measures, captive breeding and head-starting are only temporary measures. Predictive modeling suggests that these measures can likely reduce short-term extinction, but they will not save the species in the long term. It is common in reintroduction programmes for the original threats that cause a species' decline to continue to impact the introduced animals and the population as a whole. Thus, it is imperative to also address the issue of habitat loss and alteration.

Habitat improvement

Habitat loss is considered the leading cause of decline of the Oregon spotted frog. Reversing the loss of habitat is important for improving genetic diversity in the frog populations. As with COVID-19, where achieving a high proportion of vaccinated individuals is the only way to end the pandemic; improving, maintaining, and creating suitable Oregon spotted frog habitat is essential to ensuring their long-term persistence.

Of special concern is the loss and alteration of shallow breeding wetlands. This, in part, is caused by invasive reed canary grass (*Phalaris arundinacea*). Controlling invasive aquatic plants is difficult because herbicides can cause damage to amphibians and many mechanical or manipulative approaches have limited effectiveness. Fortunately, recent work has shown that some herbicides can be used without harm to the Oregon spotted frog to control the reed canary grass. These herbicides are now being applied, but eradication takes several applications over a few years.

Cattle grazing was also shown to successfully reduce reed canary grass in these habitats in 2003. However, livestock cannot remove the plant permanently, and can also lead to adverse impacts by contributing to water quality issues. To be used effectively, it should be limited to open thick stands of reed canary grass. Studies are being conducted to understand the full impact of grazing on Oregon spotted frogs. Similarly, mowing reed canary grass is a short-term solution because it will not remove the grass permanently. These solutions are reminiscent of utilizing protective equipment, such as masks, against COVID-19. They are not completely effective. However, if implemented repeatedly and universally, protective equipment can help minimise the spread. In the case of the cattle grazing and mowing, it can help to rebuild populations until more permanent solutions are found.

Apart from invasive plant management, other habitat improvements can also be made. We have all sought ways to improve our lives at homes, in order to deal with overwhelming feelings of social isolation. I have personally bought new books and other sources of entertainment. I have also created an office for myself at home.

Introducing and protecting beavers (*Castor canadensis*) is one way to improve Oregon spotted frog habitat. Beavers help create suitable habitats and increase habitat connectivity. Improving water connectivity between habitats is just as essential. Even man-made ditches can help the frogs travel farther to overwintering habitats. Additionally, improvement or maintenance of water quality, hydrology, and vegetation are also important for creating suitable habitat and ensuring habitat connectivity. Habitat improvements must focus on the physical, spatial, and environmental requirements of the Oregon spotted frog to be effective.

Conclusion

Population isolation—due to lack of habitat and water connectivity—is leading to the decline of the Oregon spotted frog, and we are largely to blame. Some of the last remaining suitable frog habitat is in my hometown. Until recently, I wasn't aware of their existence. If it were not for my own isolation during the COVID-19 lockdown, I would not have empathised as deeply with their plight. For the effective conservation of the Oregon spotted frog, habitat concerns should be addressed, populations should be augmented, and populations need to continue to be monitored. This requires both community and global involvement. Much of the Oregon spotted frog habitat in Whatcom County is on private land. Local residents, like myself, can help by spreading awareness of the frog's struggles and the different methods that can be deployed to increase habitat and water connectivity. Awareness can then lead to further community action, such as improving water quality in local waterways and advocating for beaver protection.

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Map created by Technology for Wildlife. Colour: Karunya Baskar

Alexi Guddal *is a graduate student studying biology with Project Dragonfly at Miami University and the Woodland Park Zoo. She works for the Whatcom Conservation District.*

Karunya Baskar *is a visual designer and artist who loves to travel. Whether it's scuba diving, surfing or trekking through the hills, she's always up for an outdoor adventure.*

Every Creature Has a Story-

What Science Reveals About Animal Behaviour

Author **Bijal Vachharajani**

You know how the saying (kind of) goes, 'Always judge a book by its content page?' That is at least what I was thinking when I started reading Janaki Lenin's book, *Every Creature Has a Story*. Not only does it have a beautiful cover, it has a riveting Contents page. Here are a few examples–

Airborne Sleep
Sticklebacks Hold Their Water
Wasps Enslave Spiders to Weave for Them
Pregnant Fathers
Laziness Has Its Uses
Did Moby Dick Sink the *Pequod*?

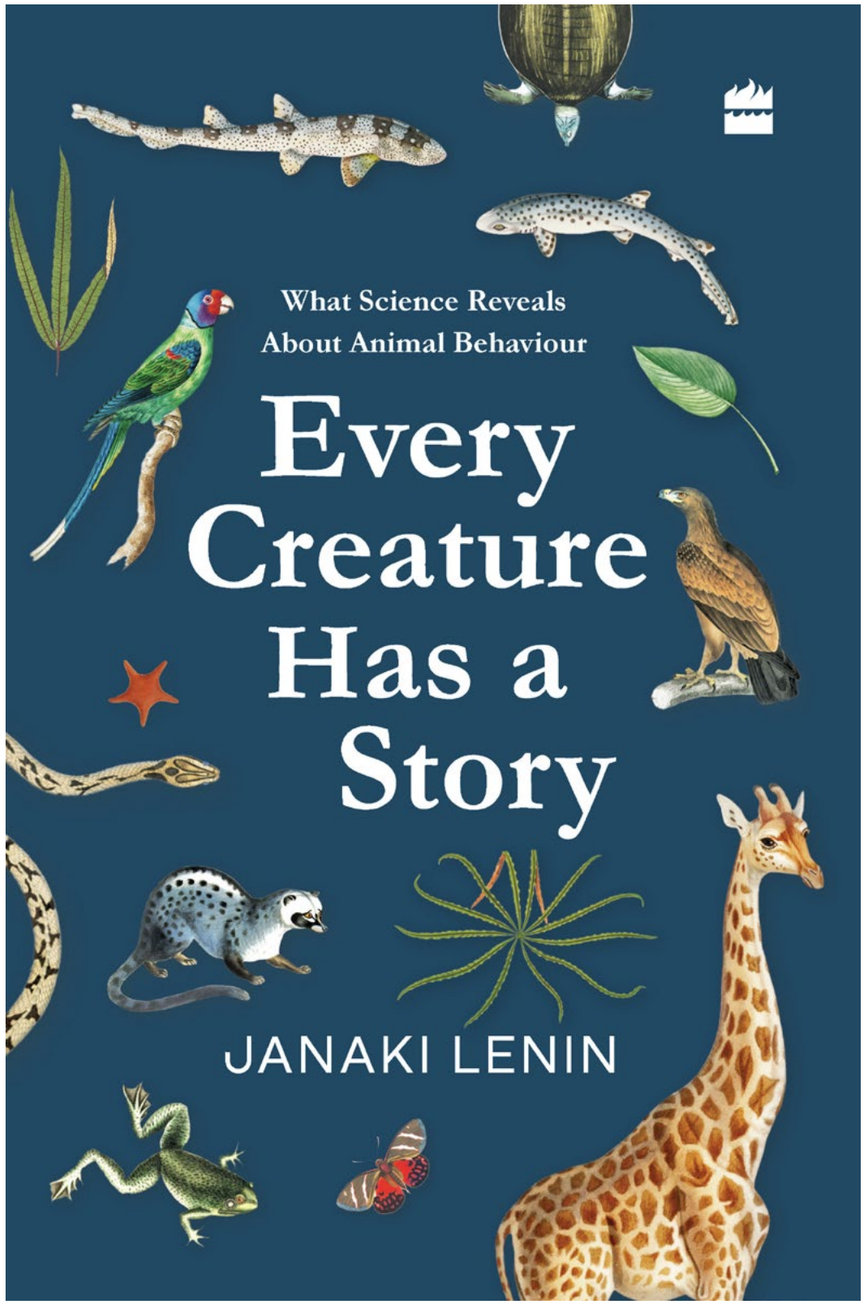
And it just gets better from there. Underscored by a tagline that tells readers, *What Science Reveals About Animal Behaviour*, author and filmmaker Lenin's book is a collection of 50 essays, updated and selected from her column in *The Wire*. Lenin's series offers a fascinating understanding of animal behaviour, while breaking down complex science and research for the reader.

For instance, in 'Rodent Monogamy' Lenin considers the question of what makes some prairie voles 'stick to one mate and the others wander?' Explaining research that otherwise would be gobbledygook for many of us, she explains the way vasopressin, a hormone produced by the hypothalamus influences social behaviours. It's enthralling stuff, suffused with generous doses of humour and insight.

I was fascinated by 'The Scent of a Fur Seal', where Lenin writes about the curious case of Antarctic fur seal mothers being able to locate their offspring after having travelled as far as 240 km over five to ten days in search of food. Countless documentaries came to mind as I read this chapter slowly, taking it all in. As a children's book author, I have always read in stories on how seahorses make for great dads, as males are the ones who get pregnant. Lenin talks to Camilla Whittington and her colleagues at the University of Sydney, Australia, to understand this better. Including how on a full moon night, the father produces 'isotocin, the fish equivalent of oxytocin' to induce labour. Never looking at a full moon night in the same way again! And that a 'big-belly seahorse dad' can produce some 1,100 babies.

Another example of good paternal behaviour that Lenin cites is that of 'young male moustached warblers' who, if the fathers do a runner, step into incubate eggs, feed the female's young chicks, and keep predators away. Surrogacy in the bird world, who'd have thought that there were so many examples, and such sound reasons for them.

There are lots of aha moments in the book, awe- and aww-inducing ones as well. Like when Lenin explores the question 'Are Humpback Whales Altruistic?' It turns out, they do go out of their way to rescue their own kind, and sometimes other creatures! Marine biologist Robert Pitman, who is with the National Marine Fisheries Service, US, offers insight into their Good Samaritan motivation—along with his colleagues, he has compiled some 115 cases of humpbacks confronting killer whales in the Pacific and Atlantic Oceans.



From looking at bird song to parenting behaviour and literary history to prey-predator relationships, the author takes on complex subjects with panache and offers scientific reasoning and research in each essay, separating fact from anecdotes. What's also fantastic is that Lenin delves into different species, but mostly she looks at oft-ignored ones—from ants to snails and shrews to wasps. It's bizarre, it's enthralling, and it's witty. And she does all of this with clarity and a scientific curiosity which is really infectious.

In her Introduction, Lenin admits that it hasn't always been easy. The basis of the essay was a column, which means short deadlines and so she appreciated the chance to 'update and tinker' with stories for the book. 'As if the challenge of getting the science right and communicating it accurately weren't enough,' she writes, 'I also aspired towards another goal—to entertain and connect with readers who knew nothing about the animals.' That is a good goal to aspire to, and Lenin achieves it and how.

Also, I must admit, having this book in hardback, given that it's so beautifully produced (not to mention extensively researched), makes it a joy to hold and read.

When it comes to animal behaviour, few Indian books approach the subject from the lens of science for mainstream narratives. Usually these strands are restricted to academia, which is why *Every Creature Has a Story* becomes something of a landmark publication. Especially at the time it has been published—we're entering into what is now being called as the Sixth Extinction, we're firmly in the Anthropocene, not to mention a pandemic, and it's become imperative, as developmental biologist K VijayRaghavan, in his foreword to the book writes, 'to understand earth's many remaining natural wonders better, even as we strive to restore it to stability.' And *Every Creature Has a Story* does just that.

When **Bijal Vachharajani** *is not reading a children's book, she is writing or editing one. Her books include A Cloud Called Bhura and So You Want to Know About the Environment. She's a certified climate worrier.*

Growing up to be a bit batty

Author **Kami Koyamatsu** | *Illustrator* **Pooja Kumar**

I'm not going to lie, I am bonkers for bats. I can point to three bat-related experiences that have piqued my curiosity and tugged at my wonderment. These experiences helped teach me that bats are fascinating, they benefit all of our lives, are an essential part of the ecosystem, and need our help now. Though some of my stories might have some saying "no, thank you", I hope that by the end you share my appreciation for the coolest creatures ever.

Up close and personal

I grew up in the middle of nowhere, the kind of town where you have to drive a few miles to get to the nearest grocery store and walk ten minutes to get to the next house over. One day my family and I returned home to find a little brown creature in the stairway. It was fuzzy, had a small snout, little black eyes, and large ears. At first glance, I thought it was a mouse, but after closer inspection, I could see wings! This little bat got stuck in our house, and my mom donned some gloves to scoop it into a container. Feeling sorry for the little bat, I put a piece of banana in the container. Of course, since all bats in the Pacific Northwest—and almost all bats in North America—are insectivorous, the bat didn't even touch the banana. When evening came we put the container outside, left the lid off, and within an hour, it flew away. This was the first time I had ever seen a bat up close, and to me, it didn't seem so scary.

If you ever come across a bat somewhere it shouldn't be, contact your local wildlife agency or rehabber. If you absolutely need to move it, make sure you wear gloves or find ways to collect the animal using a box to keep you both safe. There are a lot of mysteries about our bat populations so if you find a colony of bats, report it to your local wildlife agency. This could fill in gaps in knowledge about our local species.

In reading this you may be wondering, aren't bats dangerous? What about rabies? Viruses? Even COVID-19? Bats are thought to be rabid, but it is very rare for a bat to have rabies, and even more rare for a bat to infect a person. Usually, when someone is bitten it is because they picked up the bat without precaution and the bat is trying to defend itself. In the U.S., if a bat bites a human the bat must be tested for rabies. Testing for rabies requires killing the bat, whether or not the bat is sick.

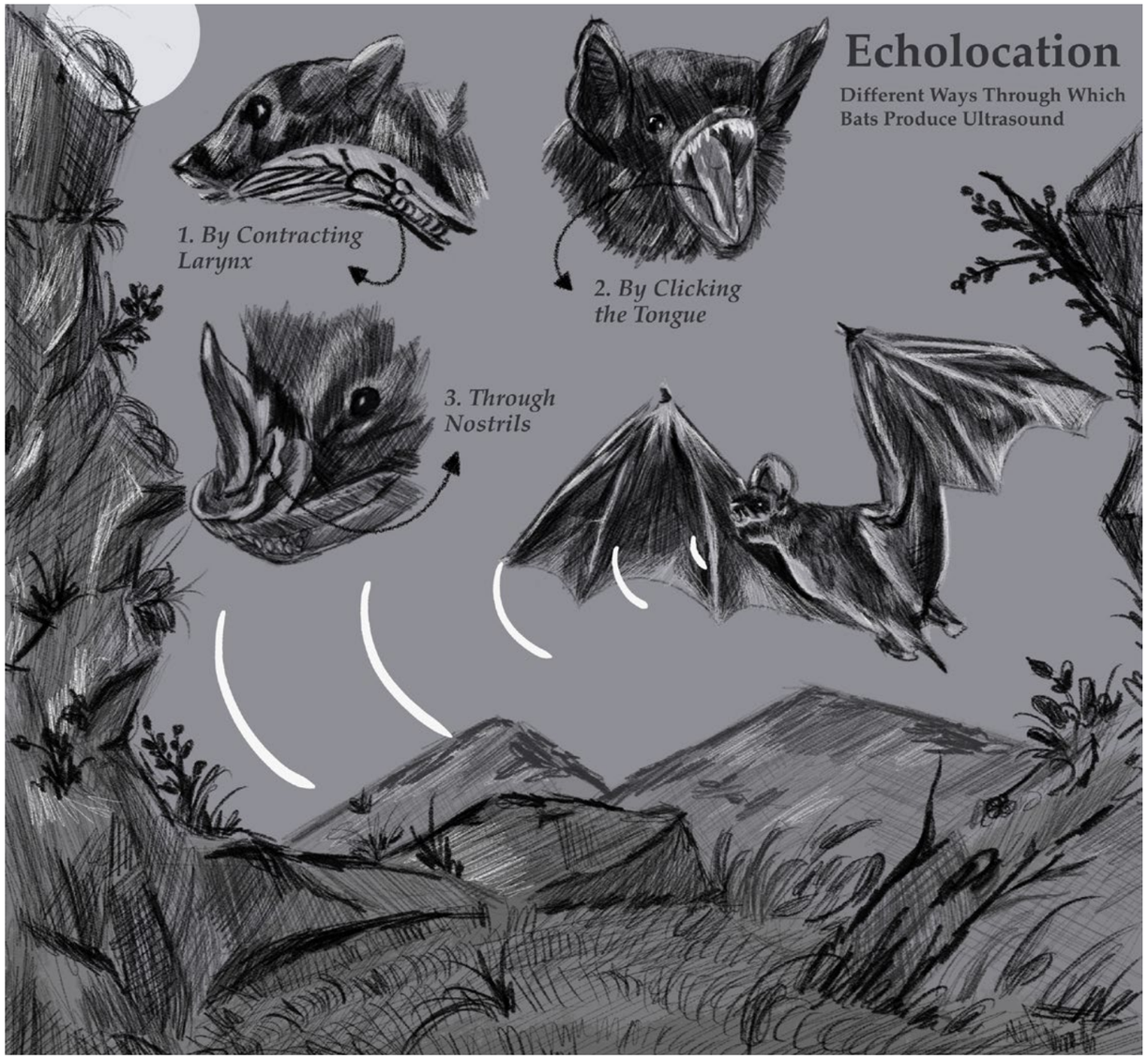
COVID-19 is believed to be a zoonotic disease that originated from an animal and has yet to be determined which animal or species it spread from. A few species of bats and other animals have been found to carry similar coronaviruses, which makes them suspected culprits. However, you cannot get COVID-19 from any North American bats. Blaming bats and eradicating or killing them will not solve issues of the current or any future pandemic. Humans are putting themselves in danger by destroying natural habitats and bringing wild animals in close contact with themselves and other animals. Bringing together different species in an unnatural and stressful environment, such as live and wet markets, give viruses new opportunities to spread.

Considering other viruses or diseases, bats should not be feared but learned from. They have incredible immune systems that work differently from humans'. When bats fly, their body temperature rises to what would be considered a fever for humans, then their temperature plummets when they torpor, or hibernate. This makes it very difficult for a virus to survive because it must endure such a wide range of temperatures within a 24-hour period. This is thought to be one of the reasons bats live unusually long for their size.

Currently, in North America, a disease called White-nose Syndrome (WNS) is devastating whole colonies of bats. The disease is caused by a fungus called *Pseudogymnoascus destructans* (Pd) that attacks bats while they are hibernating. This disturbance awakens infected bats during the winter when there are little or no insects available to eat. This depletes their fat stores, causing the bats to starve to death. Finding a bat during this season is especially important to report to your local wildlife agency. If WNS is the culprit, they will be able to gather more information about the disease. People do not have to worry about getting sick from WNS, but they should worry about accidentally spreading it. If you go into caves or near colonies it is important to clean and sanitize any clothes, equipment, or shoes between locations. It is thought that people are responsible for the spread of Pd from Europe to North America and across state lines. It seems that bats should fear people and not the other way around.

I can hear you but I can't see you

Bats are difficult to research. They are nocturnal, have the ability to fly very far, very fast, and many bats roost in inconspicuous spaces. Their unpredictable flight pattern while chasing insects makes it difficult to observe a single bat for longer than a few seconds. As night falls, it becomes difficult to see bat silhouettes zigzagging against the darkening sky. This poses the question, how do they see with no light? Bats are not blind nor do they have superb eyesight. So, what is their biological version of night vision goggles? They have something better: the ability to echolocate.



Historically, people would shoot bats with shotguns to study them. Nowadays a great way to learn about bats is through detecting their echolocation calls. Echolocation allows bats, and a few other animals, such as dolphins and shrews, to project sound that will bounce off objects like echoes. These echoes return and are translated by skillful ears into a sort of image. With this, a bat can determine how far away an object is, how big it is, and even what it is. Even though bats use sound to depict their surroundings, we cannot hear them because the series of chirps (or calls) most bats produce are at a higher frequency than humans can hear. Bat detectors are devices that translate the calls into a lower audible frequency. In some cases, knowing the frequency and waveform shape of the call is enough information to identify the species of bat.

To further my studies in the field, I went out with a bat detector to listen for bats. Recording calls cannot tell us how many bats are in the area, but it can tell us if bats are present. Bats are often associated with caves or forests, but did you know that some bats live in or frequent large cities? I recorded bat calls within the city of Seattle with an Echo Meter Touch, a bat detector that plugs into a smartphone. The accompanying app by Wildlife Acoustics identifies the species of bat in real-time. I recorded a silver-haired bat, big brown bat, and little brown bats all of which are known to live in the Seattle area. The neat thing about bat detectors is that when you are listening to the bats, you are not disturbing them and it allows you to 'see' them in the dark when you cannot watch them.

Grumpy faces and angry squeaks

By far the most exciting experience I ever had was a class field trip to Dusty Lake. Before this I liked them, but this was the moment that I really fell in love with bats. In the evening we set up a mist net trap above a small stream. A mist net resembles a very thin volleyball net with pouches which allows scientists to safely get their hands on bats (or birds). In practice, a bat will fly into the net and become stuck in a pouch. The researcher will free the bat, take measurements and notes on each individual captured. Carefully handling the bat allows for detailed data gathering, species identification, and leaves them unharmed, if not a little upset.

I had seen a bat up close before, but nothing compared to watching the interaction between my professor and the bats. My professor did all of the work while the rest of us watched in awe. As the bat was being handled it made a little grumpy face, let out a series of small frustrated squeaks, and struggled like mad to escape. Once my professor was done, he would place the little bat either in the breast pocket of his shirt or on top of his shoulder. Lo and behold the bats would just hang out—no more anger, no more squeaking, they just sat on him until they were ready to go, and then they would just fly away.

Observing these small creatures at close quarters eliminated any and all fears I ever harboured. As

I did more research, I learned bats are more similar to humans than most people would think. Bats are social animals and have a sense of community. They have been found to share food and in some cases will adopt pups who lost their mom. Bats are not the evil beings they are advertised to be in movies and horror stories but are magnificent hard workers, who just happened to get stuck with the graveyard shift.

The takeaway

You may wonder where you can see bats. Well, bats are everywhere! Or, almost everywhere. Bats live all around the world, except for in very cold climates such as Antarctica. There are over 1,400 species of bats worldwide, which are split into two groups: the microbats and megabats. Microbats are echolocators, tend to be smaller and eat a variety of prey, depending on the bat species. This includes anything from insects, scorpions, fish, nectar, and even blood. All bats in North America are part of this group, with the vast majority being insectivores. Megabats, on the other hand, tend to be larger, have better eyesight, a better sense of smell, and smaller ears in comparison. These bats are also known as the Old World fruit bats and primarily consume fruit and nectar. Their fruit eating habits actually help reforest lands by planting new trees. By eating fruit and pooping out the seeds as they fly, species of megabats disperse the seeds of mangoes, figs, bananas, and avocados, making them vital to the production of many of our favorite commercial fruits.

If you would like to observe a wild bat, just pop out around sunset and look toward the sky. Bats are most active during warmer months, and if you want to increase your chances, head to a body of water such as a lake or stream. If you are really lucky, and you happen to be near a bat colony, you might be in for quite a sight. The largest known colony—and largest known mammalian congregation—resides in Bracken Cave, Texas. Here you can watch millions of Mexican free-tailed bats exiting the cave together. There are many areas with large colonies of bats, and with a little research you might find one close to you.

All bats are incredibly important to both the ecosystem and people. They pollinate plants, disperse seeds, and eat an unfathomable number of insects. Bats need to be a high priority in research so we can learn how best to conserve them. Further, bats do not only need support from scientists, but they need support from you and me. If you are a fan, share your enthusiasm, tell your friends and family. Physical actions can also be taken, like preserving snags (dead trees) for homes, restoring native vegetation and habitat, planting night-blooming flowers, keeping your cat indoors, or joining a citizen science project to study bats yourself. **Some ongoing citizen science projects include the Long Island Bat Watch, the Spotted Bat Project hosted by Oregon State University, and Neighborhood Bat Watch throughout Canada.** There are many ways to help bats no matter where you live, how old you are, and what you do. Stand up for those who hang upside down and give them the support they need.

Further Reading

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Kami Koyamatsu *is a scientific illustrator with a passion for conservation. She is particularly fond of the night time fliers we call bats.*

Pooja Kumar *is a chemical engineer turned artist. She loves to read books about nature and is always on the lookout to explore new and creative ways to amalgamate science and art.*

There's a fly in my soup:

Insects as food for the future

Author & Illustrator **Maia D'Souza**

"As food, caterpillars are regulars in the village, but meat is a stranger."-
—A Yansi saying from the Democratic Republic of the Congo[1]

The practice of using insects as a food source is older than you might think, and is intertwined with humanity's food culture, both in the past and present, and with clues to the future.

The story begins far back in evolutionary time. To set the stage: it is around the same time as the extinction of the dinosaurs, and warming global temperatures are causing a radiation and diversification of flowering plants. Important pollinators like insects follow, as do insectivorous vertebrates (insectivorous: consuming insects as food, predominantly used for non-human animals). The first primates, the common ancestor of all apes, monkeys, and human beings today, likely evolved around this time too, 50 million years ago. This scrappy ancestor of ours was likely insectivorous as well. Like the aye-aye,

[1]Muyay, T. 1981. *Les insectes comme aliments de l'homme: Serie II*, Vol. 69. Democratic Republic of the Congo, Ceeba Publications.

tamarins, and the marmoset, several smaller primate species living today remain predominantly insectivorous.

Our story flashes forward down the human evolutionary line to the genus *Australopithecus*, evolving shortly after our split from our last common ancestor with the chimpanzees six million years ago. These 'upright walking apes' have specialisations to furnish a relatively newer innovation—walking on two legs. Bipedalism requires major adaptations in the hip joints, back, knees and feet. Many Australopithecines also show another important specialisation—the use of tools.

Tool use and diet

The archaeological site of Swartkrans is a limestone cave in the Cradle of Humankind World Heritage Site in South Africa, in which fossils have accumulated over time. It is the site of some of the oldest known bone tools used by the Australopithecine, *A. robustus*. Of particular interest here are highly polished bone tools around the size of a sausage. They have a wear pattern on the ends, consisting of fine striations parallel to their long axis. This pattern, combined with the fact that it was found on so many tools in one area, rules out the possibility of it being caused by non-human agents like weathering or gnawing by hungry carnivores. They were human tools!

These tools were generally thought to have been used to dig up tubers, which continue to be an energetically important food source today. In 2001, researchers Backwell and d'Errico took a second look. They created experimental tools, used them for various tasks, and then used microscopy to compare the resultant wear patterns with the archaeological specimens.

The surface modifications on the artefacts matched those of tools used to dig into termite mounds. Termite mounds consist of uniformly sized soil that has been finely sorted, and so unlike digging into rocky uneven soil for tubers, fine parallel wear is produced. In case of digging for tubers, the tool needs to be manoeuvred in different directions—so the pattern showed scarring that was deeper and multi-directional. Further studies have suggested a multi-use hypothesis: early humans might have used the bone tools for termite foraging in addition to digging for tubers, processing hide and harvesting bark.

In the habitat of early hominids, social insects like termites would have been abundant and easy to locate, making them a viable, nutritious addition to the diet. Even as *Homo sapiens* has evolved, that has remained true. The fact that early humans likely had insects in their diet demonstrates what a perfectly natural dietary component they are. A diet incorporating insects, with the appropriate cultural and social knowledge of which to eat and when, is as natural as a diet eating shrimp and lobster, insects' arthropod cousins.

Choosing what to eat

Today, more than 2000 species of edible insects are consumed by human beings. The UN's Food and Agricultural Organisation (FAO) estimates that insects make up the traditional diets of around two billion people.

For both hominid ancestors and modern foragers and cultivators, several considerations are made about which edible insects are eaten. What species of insects are consumed depends generally on how big they are and how many are available. To make the effort to catch them worthwhile, they must be easy to locate, preferably in large quantities. Beetles (Order Coleoptera) are the most diverse insect group, so, unsurprisingly, they are also the most commonly consumed. Caterpillars, bees, wasps, ants, and termites, along with grasshoppers and crickets, are among some of the other commonly eaten insects.

There is a rich history of edible insects in traditional and street food culture in tropical regions worldwide. Insects are consumed at various life stages and may be eaten raw, fried, boiled, roasted or ground. Edible insect consumption was widespread among pre-colonial populations in most of Asia, Africa, and large parts of South America.

Mopane worms (*Gonimbrasia belina*), the brightly coloured caterpillar of the Emperor moth, have been eaten for generations across Southern Africa. They are available seasonally and are generally handpicked, often by women and children. The caterpillars are gutted, boiled and sun-dried, which can preserve them for several months. Depending on how they are prepared, they can taste like everything from tea to burnt steak. Mopane worms are a profitable harvest, both nutritionally and economically, and they are increasingly being commercialised.

In Australia, witchetty (witjuti) grubs refer to the large, white larvae of several moths and beetles. It is most commonly used to refer to the larvae of the cossid moth *Endoxyla*. They are eaten raw or lightly cooked and are an important 'bush food' to Aboriginal Australians.

Fried spiders, while not technically insects, are a Cambodian delicacy. The practice started out as a 'hunger food' in response to crippling food scarcity during the bloody regime of the Khmer Rouge. The spider is the Thai zebra tarantula, which are safe to eat, cook quickly and have high amounts of protein and zinc. Today, the spiders are a popular deep-fried street food and tourist attraction. Worryingly, increased deforestation has threatened the spiders' natural habitat, leading to concerns over the sustainability of this food source.

Several edible insects are also 'pests' on crops. In Burkina Faso, the shea caterpillar (*Cirina butyrospermi*), known colloquially as 'chitoumou', feeds off trees grown to produce shea butter.

The seasonal collection and sale of these edible caterpillars represent a valuable income source for women in the region. The caterpillars are an important source of animal protein. If you wish to eat them immediately, the larvae may be boiled in water, and fried in butter, but the caterpillars may also be boiled and sun-dried to preserve them for sale in markets.

While wild-harvested edible insects are important supplements to traditional diets, they are often seasonal.

In central Japan, the edible wasp *Vespula flaviceps* is a delicacy. The wasps are traditionally gathered in late autumn when the nests are the largest. The process of collecting the wasps involves first creating a bait of meat to attract the carnivorous worker wasps. When a wasp is attracted, it is offered a wasp-sized piece of meat attached with a marker, made of cotton wool or plastic. If this process is successful, the wasp is followed through the forest to locate the nest. Smoke is used to sedate the wasps, and the nest is dug out for harvesting.

The harvesting is time-consuming, energy-intensive, and following the wasps across the forested mountain landscape is dangerous. Today, there has been a push for domestication, with wasp collectors relocating nests to human-made hive boxes.

Domestication is often expensive and unsuccessful, but, in this case, economics is not the primary motivator for keeping the wasps. The species remains deeply significant to the food culture, with annual festivals organising competitions for the biggest wasp nest, either harvested or cultivated. Celebrations of the wasp harvest involve various delicacies, and an opportunity to exchange knowledge about collection and cultivation.

Nutritional benefits

Edible insects present an important nutritional opportunity in a changing world. World hunger is on the rise, affecting 690 million people worldwide[2]. The world's population is estimated to be well over nine billion by 2050. Increasing our livestock production to meet these demands would increase the pressure for land and freshwater and release increased amounts of the greenhouse gases associated with conventional meat sources.

[2] FAO, IFAD, UNICEF, WFP and WHO. 2020. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. Rome, FAO.

Meeting the challenges of feeding humanity, today and in the future, will require a restructuring of our global food production systems. Edible insects are rich in protein and have an energy content similar to other sources of meat like chicken and beef. Excluding domesticated sources, fat is hard to come by in the natural world, and edible insects are an important source of the nutrient. The specific nutrient profile varies across insect species and can depend on what the insects are fed on, their stage of development, sex, and environmental factors. A higher fat content is found in insect larvae and soft-bodied species like termites, while crickets and grasshoppers, having a hard exoskeleton have lower fat levels. Although data on the exact quantities is limited, edible insects are also sources of micronutrients like zinc, calcium and vitamin A. Iron levels in insects also tend to be higher than most plant-based alternatives to meat protein.

Insects in a changing world

While humanity's ancestors might have subsisted by wild-foraging on insects for their diets, we may not be so lucky. Worldwide, insects are facing an apocalypse. Recent studies have predicted that insects could vanish within a century at their current rate of decline. The main cause of this decline? The intensification of agriculture and pesticide use. Traditional indigenous knowledge of the management of these insects and their habitat is also fast disappearing.

To avoid the unsustainable overexploitation of already-imperilled wild edible insect populations, the FAO proposes a solution—the rearing of insects for food and animal feed. Better knowledge of insect ecology, life cycles, and ecosystem dynamics could help increase efficiency while maintaining nutritional quality.

1. Southern Africa: Mopane caterpillars
2. Japan: *Vespula flaviceps* wasps
3. Assam, India: Red ant larvae (*'Amroli poruar tup'*)
4. Australia: Witchetty grub (*'Witjuti'*)
5. Southeast Asia: Palm weevil
6. South Korea: Silkworm pupae (*'Beondegi'*)
7. Mexico: Ant larvae (*'Escamoles'*)
8. Burkina Faso: Shea caterpillar (*'Chitoumou'*)
9. Cambodia: Thai zebra tarantula
10. Oaxaca, Mexico: Crickets (*'Chapulines'*)

Small-scale rearing of insects has a lighter environmental impact than typically Western forms of animal protein. Demand for animal protein increases the demand for grain and protein as fodder for livestock. Around six kilograms of plant protein are needed to feed livestock to produce one kilogram of high-quality animal protein. Being cold-blooded, insects can convert feed into increased body mass more efficiently—crickets can convert feed to meat with an efficiency two, four and twelve times that of chicken, pigs and cattle, respectively.

Edible insects produce fewer levels of greenhouse gases than most livestock and require considerably less water. As it can be done in vertically stacked boxes, insect-rearing does not need extensive land-clearing to expand production. (A necessary addendum: further research is needed into potential allergens associated with edible insects and to ensure that environmental benefits of insect rearing are retained when scaled up.)

Insects also provide household level livelihood opportunities, as this 'mini livestock' already forms a part of street food culture in many parts of the world. In urban and rural areas, involvement in cultivation, processing and sale of insects can provide a source of nutrition and extra income to marginalised groups like women and the landless.

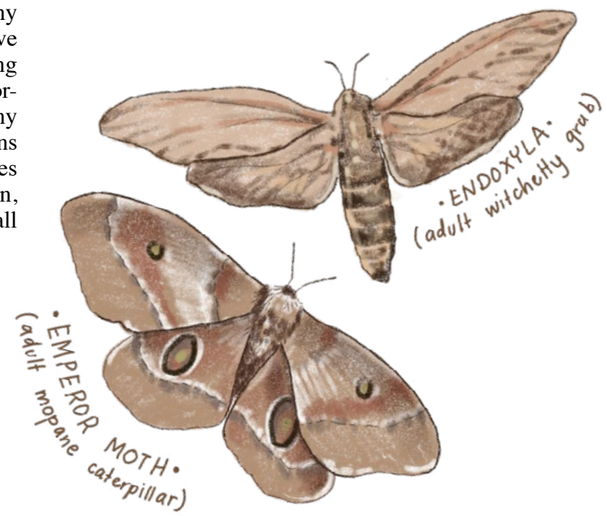
What's stopping us?

At this point, it would be worthwhile to consider why we don't already have insects as a part of our collective diet. Developing countries are seeing an increasing 'westernisation' of their diets. Western countries historically tend to look upon the practice as taboo (see: any season of the reality show *Fear Factor*). The reasons are probably twofold—the climate in northern latitudes is colder and necessitates eating meat. By comparison, in the tropics, several edible species might be found all year round, and harvests can be more predictable.

Climate might explain the lack of eating insects, but not the associated disgust. The origin of human disgust is all too often dependent on culture, on history, mobility, and, in this case, colonialism. The consumption of insects by indigenous peoples was often looked upon as further evidence of their differences from the colonialist's ideal, and was used as a justification for the dehumanisation and atrocities that followed. Disgust is often used to maintain hierarchies. Similar problems arise out of dominant perceptions of class, caste and tribe, where associated insect-eating is looked down upon, leading to the loss of these food practices.

Food and power

While considering how we can use the opportunity (both nutritional and environmental) that insects provide us, it is equally important to recognise that overhauling our food production systems provides us with the opportunity to not simply reinforce the power imbalances that brought this present crisis upon us. Resource extraction must benefit the people most threatened by food insecurity.



Since 2010, insect products are increasingly being sold online as the edible insect movement has gained traction in predominantly white countries. They are priced far higher than meat products, limiting their access from most of the world. Further, their increasing popularity among those with resources drives prices up, meaning that traditional consumers eventually may no longer have access.

Edible insect products in the market reveal little information on the social and ecological contexts of their production. A more democratic approach would involve consideration of who produces, controls and benefits from this resource. Visualising a more democratic food production system that truly benefits the underprivileged will depend on how the profits are distributed within the trade chain.

Food challenges are *not* due to a lack of food but due to structural inequalities. What structures will we be reinforcing through our food choices, both old and new?

Further Reading

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Payne, C. L. R., A. Badolo, S. Cox, B. Sagnon, D. Dobermann, C. Milbank, P. Scarborough et al. 2020. The contribution of 'chitoumou', the edible caterpillar Cirina butyrospermi, to the food security of smallholder farmers in southwestern Burkina Faso. *Food Security* 12(1): 221–234.

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Maia Lisa D'Souza *is a biology major at IISER Mohali, interested in cultures (both human and animal!). She studies marine animal behaviour, communication & conservation.*

Old wives' tales:

Weaving human-wildlife relationships in the high mountains of Ladakh

Authors **Nitish Kumar & Anish Paul** | *Illustrator* **Indrani Ghosh**

Folklore depicts the rich cultural heritage of a society's past and plays a significant role in shaping its beliefs and customs. They help inculcate values, transfer knowledge, and promote wisdom in individuals of that society. According to the study published in the journal Frontiers of Environmental Science in February 2021, folktales are also influential in paving the way for human-wildlife coexistence in the high altitudes of the Himalayas in Ladakh, India.

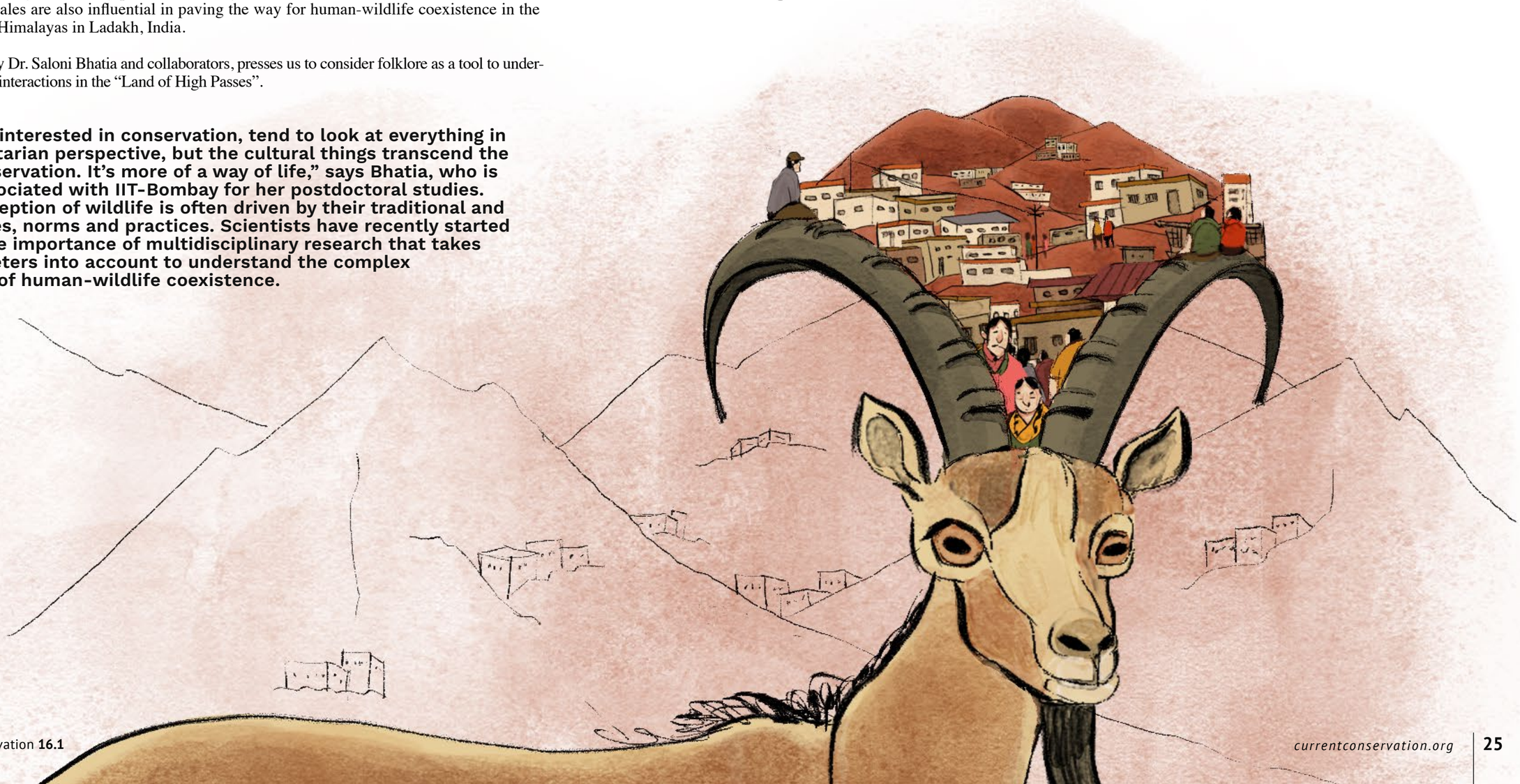
The study, authored by Dr. Saloni Bhatia and collaborators, presses us to consider folklore as a tool to understand people-wildlife interactions in the "Land of High Passes".

"We, who are interested in conservation, tend to look at everything in a sort of utilitarian perspective, but the cultural things transcend the realm of conservation. It's more of a way of life," says Bhatia, who is currently associated with IIT-Bombay for her postdoctoral studies. People's perception of wildlife is often driven by their traditional and cultural values, norms and practices. Scientists have recently started to identify the importance of multidisciplinary research that takes these parameters into account to understand the complex mechanisms of human-wildlife coexistence.

This study tried to dissect the cultural values behind the human-wildlife relationships in the Indian Trans-Himalayan region. Archived documents and semi-structured interviews with the locals were used to collect narratives about ibex, wolves, and snow leopards, as well as a mythical carnivore called *seng ge* or snow lion, often mentioned in the local Tibetan Buddhist folklore. They found that ibex were mainly associated with utilitarian and optimistic views. "The cultural connections that people have with ibex are far more nuanced and deep. If one were to think about a cultural flagship, then ibex would be more appropriate than a snow leopard," states Bhatia.

The study also revealed that wolves and snow leopards are likened with protective deities, incorporating a positive symbolism in these carnivores. More recently, such values have been overwhelmed by the animals' negative impact on human life in terms of livestock loss and human injuries. Consequently, they are chiefly being associated with negative symbolism. The mythical snow lion outvalues all the other carnivores in positive symbolism.

The study presses us to pay more attention to understanding the cultural dimensions of human-wildlife coexistence. According to Bhatia, practitioners should engage in "customised conservation messaging" to get locals on board in conservation endeavours, with a focus on issues



that the locals care about. The positive perspectives can be a factor to promote grassroots conservation, whereas the negative ones can be used to initiate conversations with the locals to promote coexistence. For example, the apparent parity between a snow lion and a snow leopard could be utilised to preserve the latter.

Apart from the conservation aspect, the value of this study lies in the repository of Ladakhi folklore. Similar methods can be applied across the country to produce a national repository of indigenous knowledge. This will help understand the complex cultural aspect of how wildlife is sharing space with humans in a densely populated country like India. Furthermore, elderly people with vast knowledge of the ecology of the landscape can act as catalysts to initiate conservation dialogues at the grassroots. They can mentor young practitioners who can imbibe the knowledge and utilise it to ensure the persistence of wildlife in these ever-changing landscapes.

Every place might have different stories and perspectives on similar or other animals, and the approach to nature conservation should be designed accordingly. "When you do conservation messaging and don't understand these nuances as a practitioner, then it is difficult to draw up a message that people can relate to," adds Bhatia.

To promote the long-term coexistence of humans and wildlife, socio-economic and cultural aspects of the locals and the ecological facets should be given equal importance in current day wildlife research. "We tend to approach conservation from a very narrow perspective defined by our own set of values," says Bhatia, "but if you just open up to the world and keep yourself open and empathetic and compassionate, there are multiple perspectives, and there's so much out there to learn from."

Folklore has the potential to influence people's perceptions of wildlife. This can be used as a framework to acknowledge the value of this cultural practice to understand the intricate details of the human-wildlife coexistence and ensure the persistence of wildlife in the country.

Further Reading:

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Nitish Kumar *is a MSc Ecology Student at Pondicherry University. Nowadays he's busy roaming in the jungles and tea gardens of North Bengal, camera trapping small cats.*

Anish Paul *is pursuing MSc in Ecology from Pondicherry University. Anish is found at his best when surrounded by nature, and wishes to stalk animals to make a living.*

Indrani Ghosh *is a visual storyteller who likes to tell stories about people and their lives. She enjoys spending time with strays and making comics with her quirky sense of humor.*

An ecologist paints a picture:

In conversation with scientist-turned-landscape artist Stephen Redpath

Picture 1: The Coll © Stephen M. Redpath

Authors **Hari Sridhar & Manini Bansal** | *Artist* **Stephen Redpath**

After working as an ecologist for over 30 years, Stephen Redpath decided to retire early from his professorship at the University of Aberdeen and take up landscape painting full time. In a conversation conducted over email, Hari Sridhar and Manini Bansal asked Steve about this decision, where his art draws ideas and inspiration from, and how being a scientist has influenced how he paints the natural world.

Hari Sridhar: In 2019, after spending over 30 years working as an ecologist, you decided to take up landscape painting. Tell us about the origins of this interest, and what motivated you to make this switch at this point in your career?

Steve Redpath: I have always had a deep love of the natural world. My earliest memories are of birds and landscapes and associated feelings of joy and connection. I grew up in a creative household—my parents were weavers in west Wales—so there were always books on art and colour and design lying around to inspire me. The woollen mill was in a beautiful part of the world and I spent much of my childhood outside, birdwatching, looking for nests, tickling fish and just messing about. I met a friend of my parents when I was ten years old and he said I could get a job as an ecologist, which I thought was amazing. A job watching birds all day! So, I set course for a degree in Ecology at Leeds University in the north of England. I followed that up with a PhD and a job at the Institute of Terrestrial Ecology. I spent 13 glorious years collecting data and, yes, watching birds. But slowly I got sucked into management and committees and grant writing etc., which I didn't enjoy as much as I did teaching and interacting with lively, young, ecologists full of passion for doing something positive in the world.

About 15 years ago, I started struggling with my mental health, and in 2009 I had a breakdown. A couple of things really helped me out of this horrible time: my lovely family and art. I drew and painted and filled up books with what were, to be honest, mostly pretty dreadful paintings, but the process of painting was so exciting and mesmerising. It also shut out the endless noise that was in my head. From that moment I made two decisions. One was to focus my academic life on conservation and specifically human-wildlife conflict, which I found fascinating, and, secondly, to retire from my job at Aberdeen University at 60 years old and pursue a life as an artist.

After ten years, I had manoeuvred my University job into something that was very stimulating. The teaching was great, I was working on some fascinating research and field projects with some wonderful people around the world. I especially loved working with the Snow Leopard Trust, the Nature Conservation Foundation, and with academics from a wide diversity of disciplines. I also had two amazing years spending time with brilliant ecologists, political scientists and psychologists in Sweden. Everything was going to plan. Then in 2019, I became ill and was eventually diagnosed with Chronic Fatigue Syndrome (CFS) or Myalgic Encephalomyelitis (ME). This is such a debilitating illness, which sucked the energy out of me and left me with

reduced cognitive function (the doctors called it 'brain fog'). I had to stop work and I was eventually forced to retire at the age of 57.

This was not what I planned, but suddenly I had time to focus on painting. It was odd. I had no energy, I could not read and on some days I even struggled to speak. But I could paint. It clearly used a different part of my brain. Since then, I have painted virtually every day. In my head, I have this huge store of images and feelings of a life in the natural world, after a career as an ecologist, and a feeling that I could explore who I am through my painting. What a treat!

HS: Walk us through your process, i.e. how you decide what to paint and how to represent it? How much of what you draw is based on memory versus painting "live"?

SR: There is no single process, and, if I'm honest, I sometimes find it hard to understand what is going on. Some days, especially when my CFS is bad, I will sit and paint whatever comes out. In a way, I just observe myself. At these moments, I'm not trying to represent a place. I'm just lost in the joy of watching pigment, water and paper interact. It is wonderfully meditative. Once I've started painting, I may make a decision to add some contrast or introduce a new colour. So, I suppose, I observe and respond and observe and respond.

On other days, I will have a place in mind, for example, a bit of coastline or an upland landscape. Again, I won't try and reproduce an exact representation—it is the feel I'm after. To me, painting is all about emotion—my response to the natural world and my attempts to capture that feeling on paper. I paint for me and I try not to think about how others will respond. So, in these situations, I chose a palette and I add a little more "editorial" control over the process, although, in reality, a lot of it is still simply observing myself (Picture 1).

Picture 2: The Angry Mountain (living with Chronic Fatigue Syndrome) © Stephen M. Redpath

Sometimes, I will try to express a specific emotion, rather than a place. For example, it may be the frustration of living with CFS (Picture 2). In these cases, I start with that feeling and then let go.

I also sketch outdoors a lot (Picture 3) and, increasingly, paint in other media such as acrylics or oils (Picture 4). In addition, I bring my sketches back to my studio and use them as an aid. Direct painting is very exciting, but a challenge when you live with CFS. It is only something I can do on "good" days. But even when I sketch outdoors, I find that I am more interested in the feel of a place and less interested in, for example, whether specific trees are in the right place or I have the line of the mountain exactly right. There is a wonderful magic that can happen when you paint and observe for hours *in situ*. I find I start to see the landscape differently and this affects how I portray it. I see new colours and contrasts and the whole thing becomes emotional and alive. A connection forms between the landscape, the painting and myself. It is glorious and fleeting, and it is a state I'm constantly striving for. I find I have a dialogue with the painting—it "talks" to me and I talk to it and a relationship forms.

This all may seem a bit odd for a man of science, but it is how I perceive the process. I try not to think about it too much. I'm simply having too much fun.

Picture 3: The Tarland Burn © Stephen M. Redpath

HS: Could you tell us a little bit about what sketching outdoors involves?

SR: When I go for walks, I tend to take a sketchbook, pencil, charcoal and maybe some pastels or watercolours. I'm always looking—it may be a simple line I'm trying to capture in my book, or the fall of light and shade over a field, or the colour of a distant hill. I fill up books with simple sketches and often use these for later inspiration in the studio. Often, I will sketch with my non-dominant hand, or I sketch "blind"—without looking at the paper at all. I find these approaches produce more interesting and satisfying reflections of what I am observing.

HS: I'm intrigued by your method of drawing with your non-dominant hand or without looking at the canvas. Could you tell us a little more about how this works for you?

SR: Just like being an ecologist, being a painter involves careful observation. To me, this doesn't mean

trying to reproduce an exact representation, like a photograph, but being honest about the feel of a place, of capturing the interplay of light and tone and contrast, to represent the energy of a landscape at that time. To sit and really see, and then try to let that seeing flow onto the paper. Sometimes, I find that using my dominant hand hinders that flow, maybe because the hand has memories of movements and tends to move in specific ways. Using the non-dominant hand gives more freedom of expression and allows for uncertain movements, which add greatly to the picture. However, I think what I enjoy the most is drawing "blind" (Picture 5), through which I can spend all my time seeing and trust my hand to reproduce. It is amazing. Maybe the tree is in totally the wrong place (for example, in the sky), but the feel of the whole piece is there. I find it fascinating that you can capture the essence of something or somewhere even if spatial configuration is scrambled.

HS: In a couple of your earlier responses, you've alluded to how being a scientist has influenced your art. Can you reflect on this a little more, in particular, about ways in which the scientist/ecologist view of the world both helps and hinders your art?

SR: Much has been written about the divide between Art and Science cultures. I tend to ignore all of that. They both seem innately interwoven in my life and I have always loved both. Consequently, I don't feel that my life as a scientist hinders my painting. On the contrary, science has taught me the value of careful observation and patience, which are fundamental to life as an artist. My life as a field ecologist, working in amazing places, and observing birds and nature, has helped my painting enormously.

Of course there are big differences in the practice of Science and Art, but I think both are trying to find truths about the world or about our individual experiences of living in the world. The main difference for me is that my time is no longer spent with a notebook and binoculars, but with a sketchbook (the binoculars are still there). I still love the excitement of natural history and the joy of finding a nest or walking in the uplands listening to calling curlews or exploring the coast and the large breeding colonies of guillemots and razorbills that occur near Aberdeen. So, on some days, I will watch and not sketch, and on other days, I will be painting and be unaware of the nest nearby. It seems a perfect life—living in a glorious place, exploring the natural world and trying to capture my experience of it on paper.

Picture 4: Ardmair Bay © Stephen M. Redpath

***Stillness* © Stephen M. Redpath**

HS: Before we end, is there anything you would like to add that hasn't been covered by the questions I've asked, but is relevant to the theme(s) of this conversation?

SR: My whole life, I have felt passionate about the beauty of the natural world, and I had 30 years as a working ecologist / conservation scientist. I wanted to make a difference and help find positive solutions to some of the thorny problems we face. In many ways, this is a traumatic discipline, and I'm sure that contributed to my breakdown and ongoing feelings of anxiety. Working in this field, it is easy to become overwhelmed by feelings of hopelessness. Art helps me deal with the effects of this trauma, and for that I will always be grateful. One of the joys of art is that it can give hope, connect people and touch something inside them to help them celebrate our world. Ecologists are not always good at speaking about hope and beauty and love. Art can open these doors and help start conversations about how we can find positive, effective ways forward. I would encourage anyone to pick up a pencil or brush and make some marks on something. Who knows where it will take you.

Picture 5: Quick 'blind' sketch of a starling sculpture © Stephen M. Redpath

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Hari Sridhar *is an independent researcher (and an honorary fellow of the Archives at NCBS) based in Bangalore, India.*

Manini Bansal *is a visual communication designer and photographer. She works as the managing editor and art director for Current Conservation.*

CURING CONSERVATION: One *pandaemic* at a time

Author **Kartel Shockington** | *Illustrator* **Amit Kaikini**

Mammaloma

In the last 20 odd years, conservation has suddenly become a universal idea, whether it is about tigers, global warming or jam. Global in the sense that the internet is: accessible to a few, comprehensible to fewer, and useful to a particular stratum of the global village. Certainly less ubiquitous than coke, but perhaps more so than fast cars. Most people tend to think of conservation either as a noble cause that one ought to be committed to, or at least something good and proper to have in the right modest quantities.

Conservationists thus tend to think of themselves as noble missionaries, in quest of the Holy Grail of pristine wilderness or environmental sustainability, depending on which camp you belong to. Some, like the animal rights gang, act with religious zeal on their convictions. Others, like the biologists, tend to be cocooned in their discipline (with perhaps a slightly exaggerated view of its importance). And yet others, like the large international organisations, tend to be forces of neo-colonisation, not unlike the multinationals they purport to detest. Of course, without a doubt, there are noble individuals in these organisations (and who is to say there are none in Coke and Pepsi). It should come as no surprise then that conservationists have the entire range of human frailties at their disposal.

In our never-ending quest to create more confusion and further muddy the waters, we argue here that we should recognise the afflictions which affect the normal functioning of the body ecologic, just as any disease would. We have already critiqued various half-baked ideas such as Half-Earth[1] and compassionate conservation[2] and discussed *megademophobia,* an obsessive fear of population increase[1]. However, as usual, we missed a trick. In fact, we missed the entire gamut of conservation diseases that affect this demographic. We attempt to make amends here with the Official Shockington Guide to Conservation Ailments And Diseases (OSGCAAD).

Ornithalgia

Vertabratitis in conservation is the expression of the broader problem of taxonomic chauvinism, or *taxoplasmosis* which makes certain taxa irresistible to biologists. The most common forms of this disease are *mammaloma*, an inordinate obsession with conserving mammals but preferably large ones. A casual survey of the conservation load of lions and tigers (*catatonia*), elephants (*pachydermatitis*), apes (*apendicitis*), pandas (*Long fo mi syndrome*), and whales (*orcaitis*) demonstrates the widespread nature of this disease. But there are other forms as well, such as *ornithalgia*, which can be diagnosed by twitching in patients. And then there is *herpes*, which results in a compulsion to collect every frog (*amphibiosis*) or lizard (*schincophrenia*) or grab every snake (*serpentitis*). And then, of course, some harbour an unhealthy relationship with sharks, which is known as *elasmobronchitis.*

Herpes

[1] Shockington, K. 2018. Half-Earth is half-hearted: Make way for Thanos and the half-universe. *Current Conservation* 12(4): 32–34.

[2] Shockington, K. 2019. Compassionate halfism. *Current Conservation* 13(3): 32–34.

Catatonia

The obsession with sea turtles (*chelora*) is truly global and can be found in almost every coastal province in the world. This leads to claims that sea turtles are endangered, even if they are found in every ocean, sea and bay; a mania for moving eggs to hatcheries; and alarming levels of affection for the ridiculously cute hatchlings. Sea turtle people have long been at loggerheads about whether the symptoms include flat or leather backs, or turning green (or black in the east Pacific). It remains a ridley.

Elasmobronchitis

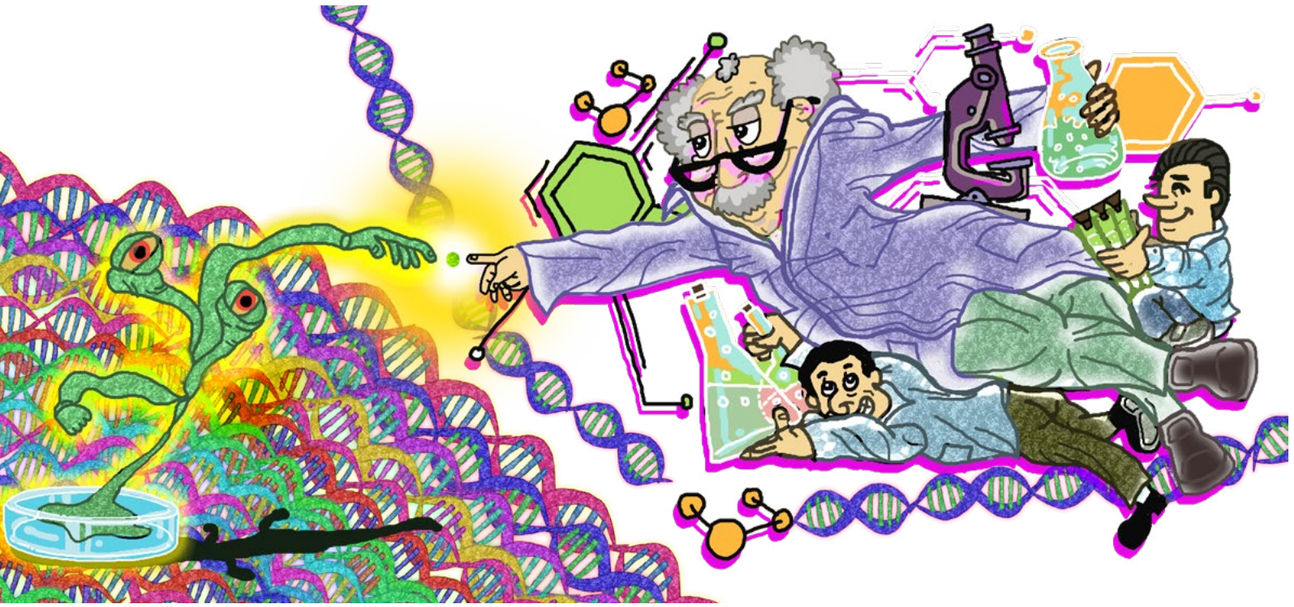
Though somewhat rarer, many cases of *invertebratitis* have been recorded too. Some suffer from *lepidospirosis*, and are seen hopping around with butterfly nets, while others have an inordinate fondness for beetles, and can only be cured by a *coleonoscopy*. The latter is not to be confused with an inordinate love of The Beatles, which we do not believe needs curing. And yet others can't stop chirping about What Katy Did. A few harbour an unhealthy obsession with shellfish, resulting in *Crustacea*, which can lead to atrophy in their *mussels* causing them to clam up. And those who learn to dive get immediately infected with *coralory* disease.

Though several of the above diseases have been widespread and can be quite infectious, some individuals developed immunity, while others received a vaccine against *taxoplasmosis* in general. However, these individuals were then found to be susceptible to *diversititis*, which is the belief that greater diversity is always better. So tropical rainforests trump the tundra. And consequently, global conservation priorities typically focus on the tropical countries of the south that have the misfortune to be both poor and the confluence of some complex relationship between species richness and the environment. A common symptom of this disease is frequent use of the word 'biodiversity' and may manifest as hot spots. A rare reverse form of this disease, where victims actually prefer lifeless landscapes, does occur and is known as *bipolar disorder*.

The above traits tend to be mutually exclusive. It is rare to find someone presenting with *catatonia* and *orcaitis* at the same time. Although they may both twitch. But a common chronic condition that can co-occur with all the above is *discoveritis*, which is the relentless drive to find new species. Almost 20,000 new species are described each year, so this is quite a common condition, and advances in molecular taxonomy are making the progression of this disease quite relentless. Small close family groups of marmosets, chimpanzees, and gibbons are now discovering that they are, in fact, barely related at all.

Aunts are a different species from their nephews and nieces, and a whole genus distant from their great grandparents. This has the obvious advantage of creating instant rarity. Once abundant populations can be rendered critically endangered with the swipe of a swab. The late Georgina Mace even complained that it was impossible to work out extinction trends in primates because of the plethora of new species.

One of the most crippling diseases is *animalia*. This goes far beyond *vertebratitis* and *diversititis* in conferring rights upon individuals. In its extreme form, this can extend to granting personhood to every plant and animal that ever lived, and vice versa.[3] The symptoms can include blurry vision, confused behaviour, excessive emotionality, and a poor diet.



And then there are disorders whose exact cause is not known. *Prejaculation* (a self-explanatory term) is a knee jerk response to just about anything, which occurs well beyond the conservation community. In this demographic, frequently proclaiming the imminent extinction of a species (usually in the press) is an obvious symptom. Many species, particularly large iconic vertebrates, have had to draw on Mark Twain to state that the 'reports of [their] death [were] grossly exaggerated'. Other, tinier, unknown ones have slipped quietly away into that good night, but who cares.

And finally, there is Pristianity, the predominant affliction of 20th century conservation, the desire to set aside exclusionary protected areas, exclusively for fellow Pristians. Some might argue that this is more a religion than a disease, but honestly, we can't tell the difference. Believed to have originated in the Wyoming province of the People's Republic of America, this has spread to all countries of the world. While some believe it may be in remission, there are particularly virulent forms that still surface from time to time. This, if anything, is a pandaemic.

Unfortunately, many people do not take these diseases seriously, or refuse to get vaccinated or just refuse to stay home when they should. Many of these diseases have had super spreaders, and several have seen community transmission. Some are in remission, others are not. We call here for a formal recognition of these conditions (preferably by the use of the phrase 'well then son, you've got a condition'), so

[3] Shockington, K. 2019. The Planthood of Persons. Current Conservation 14(2): 34–36.

that one can institute a programme of treatment and rehabilitation. This will inevitably cost bazillions of dollars of taxpayers' money. But if it helps build resilience to more diseases that might jump from the wild into human society, then we would have done a good thing. We think.

Epilogue

We attempted to publish this in several conservation journals without any success. We conclude that conservationists do not possess a *humerus*.

Further Reading

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Kartel Shockington *is a failed comic book creation with special powers of rapid hair loss. He sometimes appears as Kartik Shanker, and at other times as Dan Brockington.*

Daniel Brockington *is at University of Sheffield, UK. Email:d.brockington@sheffield.ac.uk.*

Kartik Shanker *is at Indian Institute of Science & Dakshin Foundation, Bangalore, India. Email: kshanker@gmail.com*

Amit Kaikini *is a freelance illustrator, with a decade of experience in digital advertising. He loves to explore Sci-Fi & Horror genres, with an inclination towards nature & a desire for surreal storytelling.*